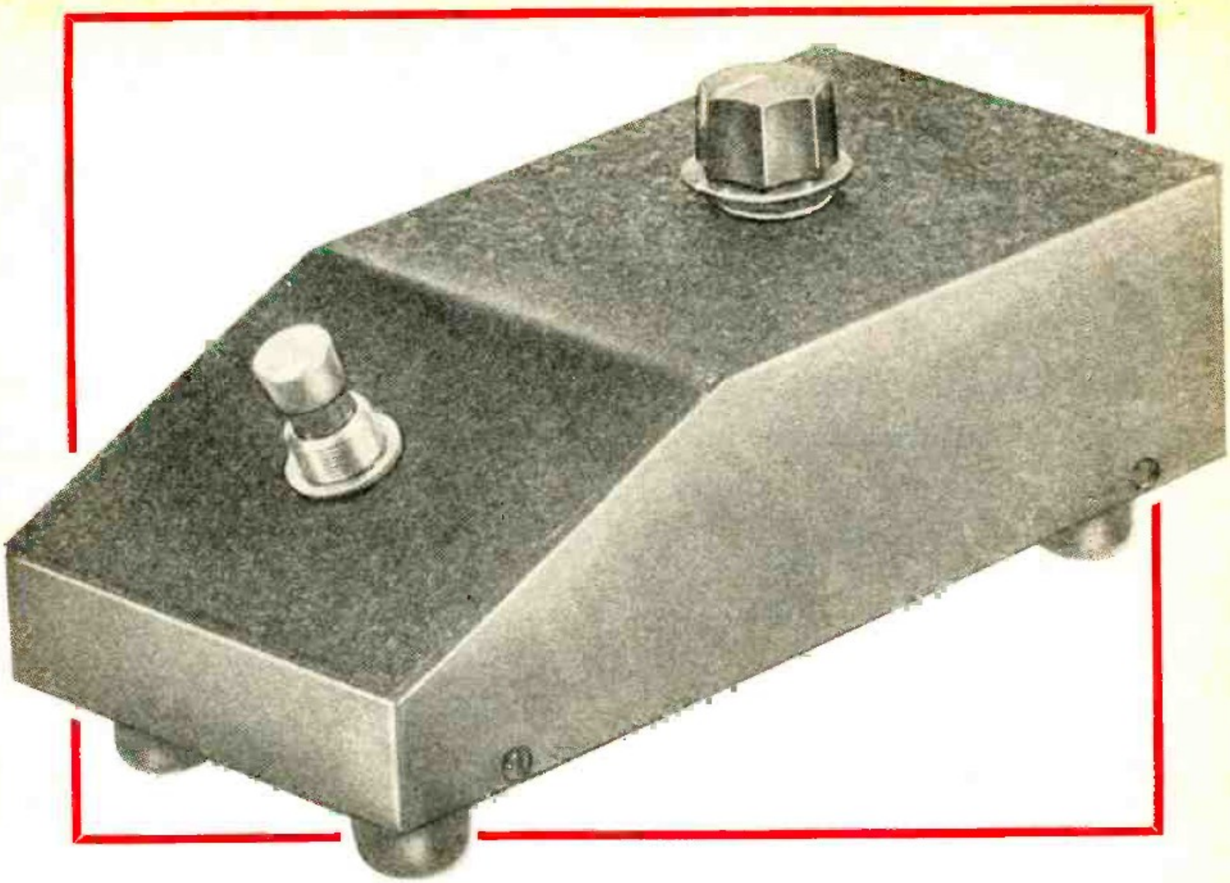

BY ANTHONY LEO*

# Build Fuzz-Box for Electric Guitar

### USEFUL ADJUNCT TO ANY ELECTRIC GUITAR IS CONNECTED BETWEEN AMPLIFIER AND GUITAR OUTPUT

PRACTICALLY every electric guitarist—who plays music in the modern-day idiom—has some use for fuzz-tone. There are several methods for obtaining "fuzz," probably the simplest being to place two back-to-back semiconductor diodes across the speaker connection at the guitar amplifier's output transformer. By connecting the diodes in such a fashion, both positive and negative peaks of the signal excursion are clipped.

Such a method does have disadvantages, the principal one being a virtual short circuit across the output transformer when the circuit is conducting at the peaks of the signal excursion. This places a severe stress on the output stage and, simultaneously, the diodes restrict the available power output of the guitar amplifier (there can be no appreciable decrease of volume and power when "fuzz" is applied).

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*Edited from the original article published in *ELECTRONICS Australia*, August, 1967; by special arrangement.

## PARTS LIST

*B1—9-volt battery*
*C1—0.27-µF capacitor*
*C2—0.001-µF capacitor*
*C3—0.47-µF capacitor*
*J1—Phone jack*
*Q1,Q2—2N3565, MPS6514, or similar*
*R1—47,000-ohm, ½-watt resistor*
*R2—15,000-ohm, ½-watt resistor*
*R3—470-ohm, ½-watt resistor*
*R4—680,000-ohm, ½-watt resistor*
*R5—4.7-megohm, ½-watt resistor*
*R6—50,000-ohm linear potentiometer*
*R7—6800-ohm, ½-watt resistor*
*R8—68,000-ohm, ½-watt resistor*
*R9—10,000-ohm, ½-watt resistor*
*S1—S.p.s.t. switch*
*S2—2-pole, double-throw switch*

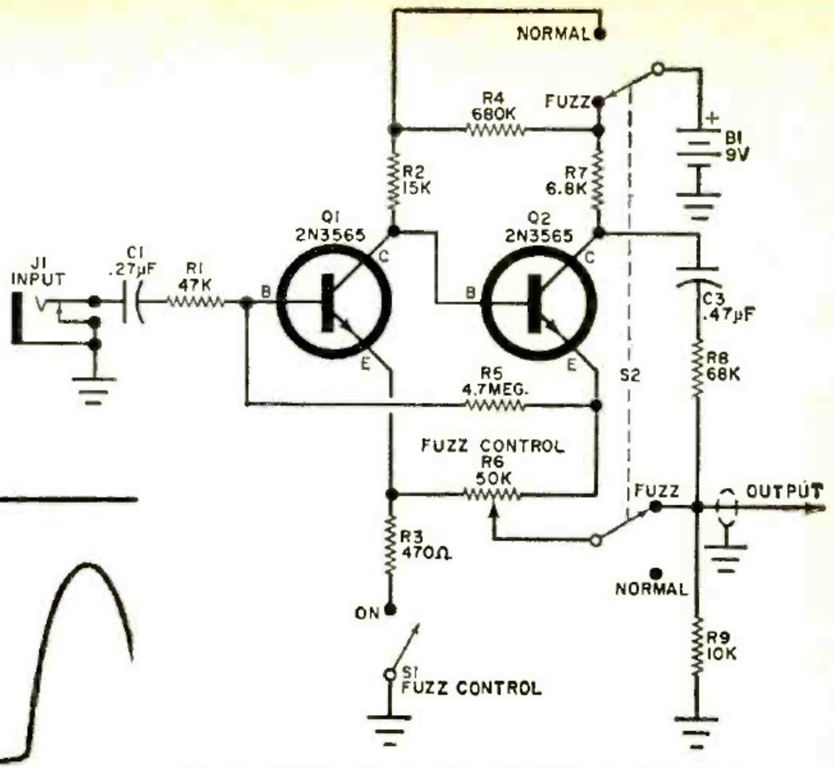
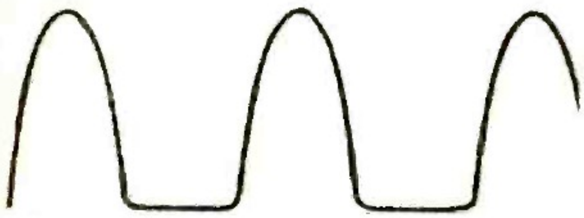
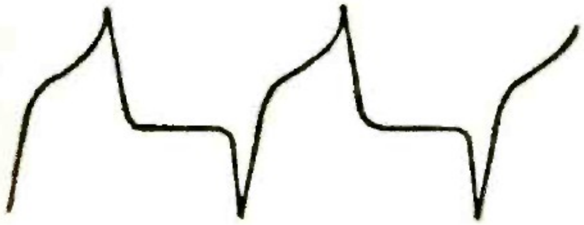


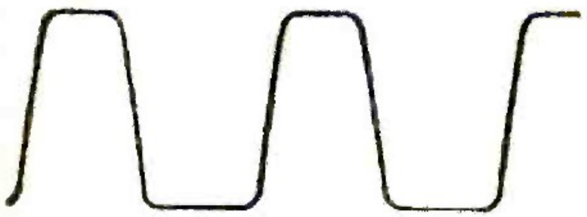
Fig. 1. Switch S1 in the Fuzz-Box is part of potentiometer R6. Turn it off to extend battery life.



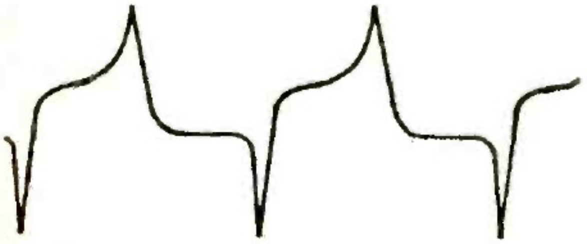
Fuzz "On"—Control R6 at minimum—30-mV input



Fuzz "On"—Control R6 at maximum—30-mV input



Fuzz "On"—Control R6 at minimum—60-mV input



Fuzz "On"—Control R6 at maximum—60-mV input

Fig. 2. The amount of distortion introduced by this circuit is largely independent of guitar output.

A considerably neater method is to pass the guitar signal through a small transistorized amplifier whose operating conditions can be modified to go into the overload mode—using only the direct guitar signal voltage. This method has the additional obvious advantage that the relative loudness of the guitar signal, with and without fuzz, can be made without continuously readjusting the guitar amplifier volume.

As seen in Fig. 1, this "fuzz-box" contains a two-stage direct-coupled transistor amplifier with a means to switch the fuzz-tone in or out, as well as to adjust the basic fuzz-tone waveform. Typical waveforms obtained from the output of the "fuzz-box" are shown in Fig. 2.

**Construction.** The most important factor to consider in constructing this device is that it must be small and robust. The prototype was housed in a small steel box that contains the entire circuit (including battery) and has the "fuzz-normal" switch on the sloping panel and the "fuzz-control" potentiometer (*R6*) on the top panel. The bottom plate has

(*Continued on page* 100)

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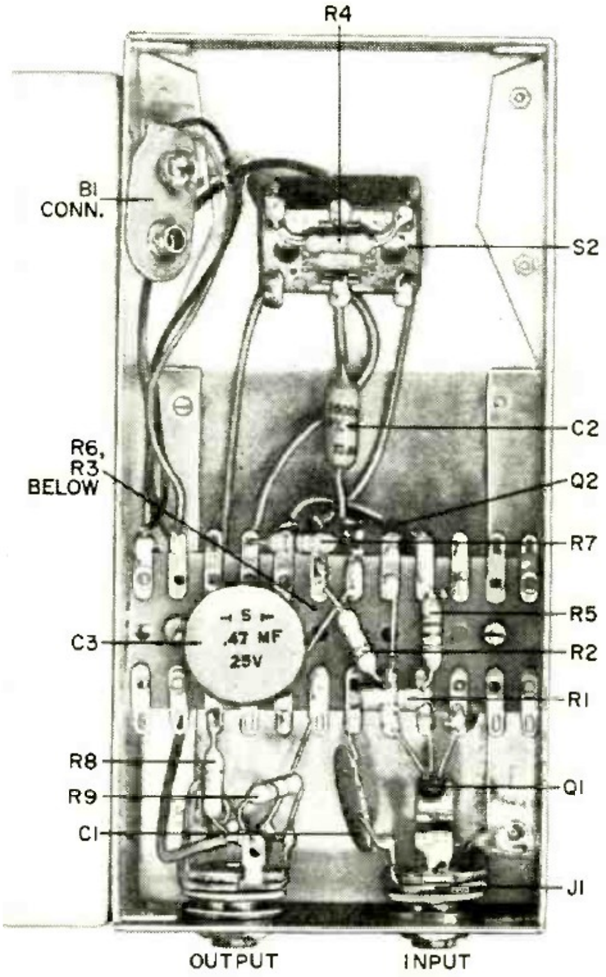
## FUZZ-BOX

(*Continued from page 42*)



Here is the completed Fuzz-Box as viewed from the bottom. You can make your own cabinet if you wish.

four rubber feet that are attached to the underside by self-tapping screws.*

The wiring of the "fuzz-box" is straightforward and was accommodated on a strip panel that contained 12 solder lugs on each side. Similar boards are available in the U.S. in the war surplus marketplace, or one may be cut down from a USECO terminal board Type 1100B (Allied Radio Stock Number 47 E 2910).

**Using the Fuzz-Box.** The "fuzz-box" should be used with a guitar that has a reasonably high level output. The actual

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**The metal box shown in the photo on page 41 was made especially for this project by an Australian manufacturer. Somewhat similar steel boxes are believed to be available in the U.S. from electrical supply houses.*

## HOW IT WORKS

When switched into the circuit, the load seen by transistor *Q1* is the sum of the values of resistors *R2* and *R4*. With the forward bias applied, this is sufficient to bring *Q1* nearer current saturation. Because *Q2* is d.c.-coupled to the collector of *Q1*, *Q2* will simultaneously be held near cutoff. When a sinusoidal signal (which has both positive and negative peaks) is applied to the base of *Q1*, this transistor will be driven alternately positive and negative. On the positive swing of the input signal, *Q1* will be driven into complete saturation, limiting the collector's voltage swing and resulting in a clipped signal peak at the collector of *Q1*.

However, the voltage across the load (*R2* and *R4*) is sufficient to allow a full and unclipped collector voltage swing on the other half-cycle. The resulting waveform is a sine wave with a clipped negative peak. At *Q2*, the unaffected signal peak will drive this transistor into complete cutoff, delivering a signal at the output that now has both peaks clipped.

Since a distorted signal appears at the emitter of *Q1*, the addition of higher frequency components from this out-of-phase waveform results in a large spike above the trailing edge of the initial, squared output waveform. Potentiometer *R6* is the emitter load for *Q2* and it is used to vary the fuzz-tone shape.

gain through the "fuzz-box" is largely a function of the output divider resistors, *R8* and *R9*. With the values chosen, there is a small signal gain of about 1.5.

You will have to remember to switch the "fuzz-box" off at the end of each performance, to obviate unnecessary drain from the battery. Fortunately, the penalty for occasionally forgetting to do so is not very great since the current drain is less than 1 mA and, overall, the battery should last about its natural shelf life. -30-

## WHAT IS FUZZ-TONE?

Fuzz, or fuzz-tone, as applied to electric guitar music is intentional distortion. The electric guitar produces reasonably clean sinusoidal waves with strong consonant harmonics—depending on the playing technique and the position of the pickup coils. These sinusoidal waves are squared off, clipped, or otherwise distorted by adding multiple hormonics and dissonant frequencies through intermodulation distortion. The naturally "round" tone of the electric guitar takes on a strident quality.

Musicians seem to prefer electric guitar fuzz-tones with great sonic impact, and this is best accomplished through a concentration of spurious harmonics within the normal musical range of the guitar system—that is, up to about 3 kHz. Fuzz-tone is intended primarily to add stridency to single tones, or simple chords. It cannot be used with complex chords, and most guitars switch out the fuzz-tone circuit when such chords are being played.

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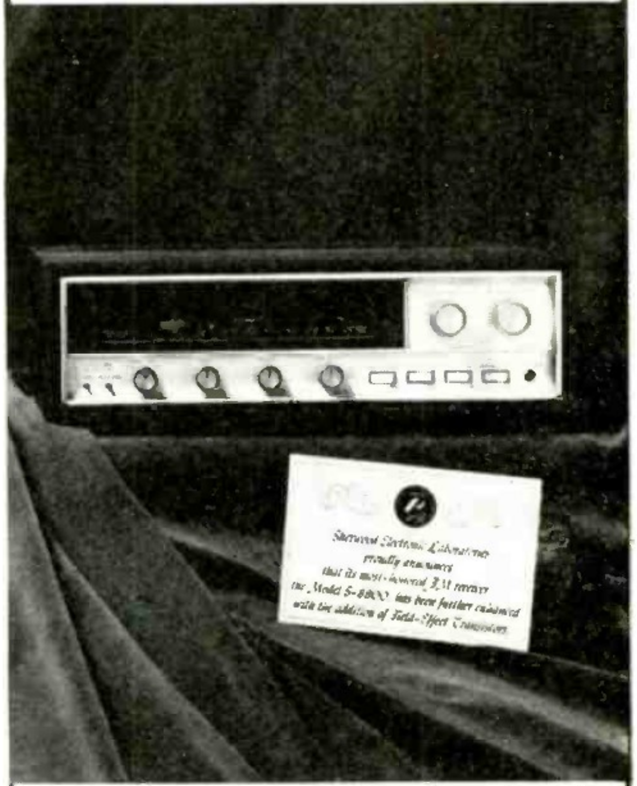

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